

## **Report from the Airplane Performance Harmonization Working Group**

### **Issue: Turboprop Landing Distance Factor**

#### **Rule Section: FAR 121.195/197, FAR 135.385/387 / JAR-OPS 1.515**

**1 - What is underlying safety issue to be addressed by the FAR/JAR?** [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The FAR and the JAR landing limitations include safety margins for landing performance such that the landing distance determined in accordance with FAR/JAR 25.125 must be less than the runway length available by a specified amount. The amount is specified in terms of a percentage (less than 100%) of the full length of the available runway. That is, the aircraft must be able to perform a landing to a complete stop in less than the full length of the runway. This requirement provides a safety margin for variations in performance, runway surface, pilot technique, differences between conditions existing at the time of dispatch and the time of landing, etc. The greater the percentage applied, the closer the landing distance required gets to the runway length available. Therefore a larger percentage represents a smaller margin.

**2 - What are the current FAR and JAR standards relative to this subject?** [Reproduce the FAR and JAR rules text as indicated below.]

**Current FAR text:**

#### **Part 121**

##### **FAR 121.195 Airplanes: Turbine engine powered: Landing limitations: Destination airports.**

- (a) No person operating a turbine engine powered airplane may take off that airplane at such a weight that (allowing for normal consumption of fuel and oil in flight to the destination or alternate airport) the weight of the airplane on arrival would exceed the landing weight set forth in the Airplane Flight Manual for the elevation of the destination or alternate airport and the ambient temperature anticipated at the time of landing.
- (b) Except as provided in paragraph (c), (d), or (e) of this section, no person operating a turbine engine powered airplane may take off that airplane unless its weight on arrival, allowing for normal consumption of fuel and oil in flight (in accordance with the landing distance set forth in the Airplane Flight Manual for the elevation of the destination airport and the wind conditions anticipated there at the time of landing), would allow a full stop landing at the intended destination airport within 60 percent of the effective length of each runway described below from a point 50 feet above the intersection of the obstruction clearance plane and the runway. For the purpose of

determining the allowable landing weight at the destination airport the following is assumed:

(1) The airplane is landed on the most favorable runway and in the most favorable direction, in still air.

(2) The airplane is landed on the most suitable runway considering the probable wind velocity and direction and the ground handling characteristics of the airplane, and considering other conditions such as landing aids and terrain.

(c) A turbopropeller powered airplane that would be prohibited from being taken off because it could not meet the requirements of paragraph (b)(2) of this section, may be taken off if an alternate airport is specified that meets all the requirements of this section except that the airplane can accomplish a full stop landing within 70 percent of the effective length of the runway.

(d) Unless, based on a showing of actual operating landing techniques on wet runways, a shorter landing distance (but never less than that required by paragraph (b) of this section) has been approved for a specific type and model airplane and included in the Airplane Flight Manual, no person may takeoff a turbojet powered airplane when the appropriate weather reports and forecasts, or a combination thereof, indicate that the runways at the destination airport may be wet or slippery at the estimated time of arrival unless the effective runway length at the destination airport is at least 115 percent of the runway length required under paragraph (b) of this section.

(e) A turbojet powered airplane that would be prohibited from being taken off because it could not meet the requirements of paragraph (b)(2) of this section may be taken off if an alternate airport is specified that meets all the requirements of paragraph (b) of this section.

**FAR 121.197 Airplanes: Turbine engine powered: Landing limitations: Alternate airports.**

No person may list an airport as an alternate airport in a dispatch or flight release for a turbine engine powered airplane unless (based on the assumptions in § 121.195 (b)) that airplane at the weight anticipated at the time of arrival can be brought to a full stop landing within 70 percent of the effective length of the runway for turbopropeller powered airplanes and 60 percent of the effective length of the runway for turbojet powered airplanes, from a point 50 feet above the intersection of the obstruction clearance plane and the runway. In the case of an alternate airport for departure, as provided in § 121.617, allowance may be made for fuel jettisoning in addition to normal consumption of fuel and oil when determining the weight anticipated at the time of arrival.

## Part 135

### **FAR 135.385 Airplanes: Large transport category airplanes: Turbine engine powered: Landing limitations: Destination airports.**

- (a) No person operating a turbine engine powered large transport category airplane may take off that airplane at such a weight that (allowing for normal consumption of fuel and oil in flight to the destination or alternate airport) the weight of the airplane on arrival would exceed the landing weight set forth in the Airplane Flight Manual for the elevation of the destination or alternate airport and the ambient temperature anticipated at the time of landing.
- (b) Except as provided in paragraph (c), (d), or (e) of this section, no person operating a turbine engine powered large transport category airplane may take off that airplane unless its weight on arrival, allowing for normal consumption of fuel and oil in flight (in accordance with the landing distance set forth in the Airplane Flight Manual for the elevation of the destination airport and the wind conditions anticipated there at the time of landing), would allow a full stop landing at the intended destination airport within 60 percent of the effective length of each runway described below from a point 50 feet above the intersection of the obstruction clearance plane and the runway. For the purpose of determining the allowable landing weight at the destination airport the following is assumed:
  - (1) The airplane is landed on the most favorable runway and in the most favorable direction, in still air.
  - (2) The airplane is landed on the most suitable runway considering the probable wind velocity and direction and the ground handling characteristics of the airplane, and considering other conditions such as landing aids and terrain.
- (c) A turbopropeller powered airplane that would be prohibited from being taken off because it could not meet the requirements of paragraph (b)(2) of this section, may be taken off if an alternate airport is specified that meets all the requirements of this section except that the airplane can accomplish a full stop landing within 70 percent of the effective length of the runway.
- (d) Unless, based on a showing of actual operating landing techniques on wet runways, a shorter landing distance (but never less than that required by paragraph (b) of this section) has been approved for a specific type and model airplane and included in the Airplane Flight Manual, no person may takeoff a turbojet powered airplane when the appropriate weather reports and forecasts, or a combination thereof, indicate that the runways at the destination airport may be wet or slippery at the estimated time of arrival unless the effective runway length at the destination airport is at least 115 percent of the runway length required under paragraph (b) of this section.

(e) A turbojet powered airplane that would be prohibited from being taken off because it could not meet the requirements of paragraph (b)(2) of this section may be taken off if an alternate airport is specified that meets all the requirements of paragraph (b) of this section.

**FAR 135.387 Airplanes: Large transport category airplanes: Turbine engine powered: Landing limitations: Alternate airports.**

No person may select an airport as an alternate airport for a turbine engine powered large transport category airplane unless (based on the assumptions in § 135.385 (b)) that airplane, at the weight anticipated at the time of arrival, can be brought to a full stop landing within 70 percent of the effective length of the runway for turbopropeller-powered airplanes and 60 percent of the effective length of the runway for turbojet powered airplanes, from a point 50 feet above the intersection of the obstruction clearance plane and the runway.

**Current JAR text:**

**JAR-OPS 1.515 Landing – Dry Runways (See AMC OPS 1.510 and 1.515)**

- (a) An operator shall ensure that the landing mass of the aeroplane determined in accordance with JAR-OPS 1.475(a) for the estimated time of landing at the destination aerodrome and at any alternate aerodrome allows a full stop landing from 50 ft above the threshold:
  - (1) For turbo-jet powered aeroplanes, within 60% of the landing distance available; or
  - (2) For turbo-propeller powered aeroplanes, within 70% of the landing distance available.
  - (3) For Steep Approach procedures the Authority may approve the use of landing distance data factored in accordance with subparagraphs (a)(1) and (a)(2) above as appropriate, based on a screen height of less than 50 ft, but not less than 35 ft. (See Appendix 1 to JAR-OPS 1.515(a)(3).).
  - (4) When showing compliance with sub-paragraphs (a)(1) and (a)(2) above, the Authority may exceptionally approve, when satisfied that there is a need (see Appendix 1), the use of Short Landing Operations in accordance with Appendices 1 and 2 together with any other supplementary conditions that the Authority considers necessary in order to ensure an acceptable level of safety in the particular case.

- (b) When showing compliance with subparagraph (a) above, an operator must take account of the following:
  - (1) The altitude at the aerodrome.
  - (2) Not more than 50% of the head-wind component or not less than 150% of the tailwind component; and
  - (3) The runway slope in the direction of landing if greater than +/-2%.
- (c) When showing compliance with subparagraph (a) above, it must be assumed that:
  - (1) The aeroplane will land on the most favourable runway, in still air; and
  - (2) The aeroplane will land on the runway most likely to be assigned considering the probable wind speed and direction and the ground handling characteristics of the aeroplane, and considering other conditions such as landing aids and terrain. (See IEM OPS 1.515(c).).
- (d) If an operator is unable to comply with sub-paragraph (c)(1) above for a destination aerodrome having a single runway where a landing depends upon a specified wind component, an aeroplane may be dispatched if 2 alternate aerodromes are designated which permit full compliance with sub-paragraphs (a), (b) and (c). Before commencing an approach to land at the destination aerodrome the commander must satisfy himself that a landing can be made in full compliance with JAR-OPS 1.510 and subparagraphs (a) and (b) above.
- (e) If an operator is unable to comply with sub-paragraph (c)(2) above for the destination aerodrome, the aeroplane may be dispatched if an alternate aerodrome is designated which permits full compliance with sub-paragraphs (a), (b) and (c).

**2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?** [Reproduce text from issue papers, special conditions, policy, certification action items, etc., that have been used relative to this issue]

N/A

**3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?** [Explain the differences in the standards or policy, and what these differences result in relative to (as applicable) design features/capability, safety margins, cost, stringency, etc.]

The FAR requires both turbojet and turbopropeller airplanes to be able to perform a full stop landing at the destination airport within 60 percent of the available landing distance. For alternate airports, turbopropeller airplanes need only be capable of coming to a full

stop landing within 70 percent of the available landing distance. The JAR requirement for both destination and alternate airports is that turbojet airplanes must be able to perform a full stop landing at within 60 percent of the available landing distance, but turbopropeller airplanes are only required to come to a full stop landing within 70 percent of the available landing distance.

**4 - What, if any, are the differences in the current means of compliance?** [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

N/A – The Working Group is recommending changes to the FAR only, therefore differences in means of compliance are not pertinent.

**5 – What is the proposed action?** [Describe the new proposed requirement, or the proposed change to the existing requirement, as applicable. Is the proposed action to introduce a new standard, or to take some other action? Explain what action is being proposed (not the regulatory text, but the underlying rationale) and why that direction was chosen for each proposed action.]

The proposed action applies to the FAR only. Harmonization of the FAR and JAR is not considered practical at this time. The operational arena in Europe has significant differences from that of North America. These differences include fleet mix, typical distances to alternates, typical airport configuration, typical stage profiles, and meteorological factors, all of which affect the safety impact of the proposed action. As a result, the magnitude of safety improvements that can realistically be expected is less for Europe than North America. That notwithstanding, the Working Group proposes to modify the FAR to provide identical requirements for all turbine-powered aircraft (either turbojet or turbopropeller). The performance characteristics and design characteristics of modern air carrier aircraft are such that large turbopropeller types operate with similar performance characteristics to smaller turbojet types, so the distinction based on powerplant is no longer valid.

**For each proposed change from the existing standard, answer the following questions:**

**6 - What should the harmonized standard be?** [Insert the proposed text of the harmonized standard here]

Overall, the issue was not considered for harmonization because the existing disharmony creates no economic imbalance between US and European operators. NOTE: The proposed FAR standard shown below reflects changes concerning issues other than the subject of this report. The proposed FAR standard follows. Specific changes are summarized and explained following each section:

**FAR 121.195 Airplanes: Turbine Engine Powered: Landing Limitations:  
Destination Airports**

(b) Except as provided in paragraph (d) of this section, no person operating a turbine engine powered airplane may take off that airplane unless its weight on arrival, allowing for normal consumption of fuel and oil in flight, would allow a full stop landing in accordance with the landing distance set forth in the Airplane Flight Manual at the intended destination airport within 60 percent of the landing distance available described below from a point 50 feet above the landing threshold. For the purpose of determining the allowable landing weight, the following is assumed:

- (1) The airplane is landed on the most favorable runway and in the most favorable direction, in still air; and
- (2) The airplane is landed on the runway most likely to be used considering the probable wind velocity and direction and the ground handling characteristics of the airplane, and considering other conditions such as landing aids and terrain.

#### SUMMARY OF CHANGES:

Relative to the existing FAR, the term “landing threshold” would replace “the intersection of the obstruction clearance plane and the runway” and the phrase “runway most likely to be used” would replace “most suitable runway”. These proposed changes are discussed in Working Group Report 12. In addition, the references to paragraphs that make exceptions to the above rule are changed. The current FAR text refers to exceptions in subparagraphs (c), (d), and (e). In the proposed FAR text, the exceptions are changed as noted below.

- (d) An airplane that would be prohibited from being taken off because it could not meet the requirements of paragraph (b)(2) of this section may be taken off if an alternate airport is specified that meets all the requirements of paragraph (b) of this section.
- (e) No person may take off a turbine engine powered airplane when the appropriate weather reports and forecasts, or a combination thereof, indicate that the runways at the destination airport may not be dry at the estimated time of arrival unless the landing distance available at the destination airport is at least 115 percent of the runway length required under paragraph (b) of this section.
- (f) A landing distance on a wet runway with a landing distance available shorter than that required by paragraph (e) of this section, but not less than that required by paragraph (b) of this section, may be used if a shorter wet runway landing distance has been approved for a specific type and model airplane and included in the Airplane Flight Manual.

#### SUMMARY OF CHANGES:

Relative to the FAR, the proposed wording in new subparagraphs (d), (e) and (f) collectively replace existing (c), (d) and (e) eliminates distinctions between turbojet and turbopropeller aircraft with respect to allowing alleviation from the requirements of b(2). and also with respect to wet runway accountability. The proposed wet runway

accountability also harmonizes the FAR with the JAR. The JAR retains differences in the requirements for turbopropeller aircraft compared to turbojets. It is not considered feasible to harmonize this provision for the reasons outlined in item 5 above.

**FAR 121.197 Airplanes: Turbine Engine Powered: Landing Limitations: Alternate Airports**

- (b) No person may list an airport as an alternate airport in a dispatch or flight release for a turbine engine powered airplane unless (based on the assumptions in section 121.195(b) and the conditions in § 121.195(c)) that airplane at the weight anticipated at the time of arrival can be brought to a full stop within 60 percent of the landing distance available, from a point 50 feet above the landing threshold.

**SUMMARY OF CHANGES**

The proposed wording reflects elimination of the distinction (with respect to alternate airport landing distance requirements) between turbopropeller and turbojet aircraft as noted above for destination airports. In addition, use of the landing threshold (vice the intersection of the runway and obstacle clearance plane) is introduced as noted for destination airports.

- (c) No person may list as an alternate airport in a dispatch or flight release for a turbine powered airplane when the appropriate weather reports and forecasts, or a combination thereof, indicate that the runways at the alternate airport may not be dry at the estimated time of arrival unless the landing distance available at the alternate airport is at least 115 percent of the landing distance required under paragraph (b) of this section.

**SUMMARY OF CHANGES**

This new proposed paragraph harmonizes the FAR with the JAR by requiring wet runway accountability at alternate airports for all turbine powered aircraft. The existing FAR has this provision only for turbojets at the destination airport.

- (d) An alternate airport with a landing distance available shorter than that required by paragraph (c) of this section, but not less than that required by paragraph (b) of this section, may be listed in a dispatch or flight release if a shorter wet runway landing distance has been approved for a specific type and model airplane and included in the Airplane Flight Manual.

**SUMMARY OF CHANGES**

The proposed wording harmonizes the FAR with the JAR and allows use of an approved AFM landing distance shorter than that specified by the basic requirement for alternates in the same manner as it is currently allowed for destination airports.

- (e) In the case of an alternate airport for departure, as provided in section 121.617, allowance may be made for fuel jettisoning in addition to normal consumption of fuel and oil when determining the weight anticipated at the time of arrival.

**SUMMARY OF CHANGES**

This requirement is the same as the existing FAR, and is restated in a separate subparagraph for clarity.



**7 - How does this proposed standard address the underlying safety issue (identified under #1)?** [Explain how the proposed standard ensures that the underlying safety issue is taken care of.]

The proposed standard provides equal safety margins for all turbine powered aircraft, either turbopropeller or turbojet.

**8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.** [Explain how each element of the proposed change to the standards affects the level of safety relative to the current FAR. It is possible that some portions of the proposal may reduce the level of safety even though the proposal as a whole may increase the level of safety.]

Because increased required runway lengths and wet runway accountability are required by the proposed standard but not the current standard, safety margins are improved for some aircraft and held the same for others. Therefore, the overall level of safety is increased. In addition, the level of safety is made the same for all turbine engine powered aircraft. The following factors were considered in making this determination:

- (a) Speed – Approach speed for aircraft such as the L-188, CV-580, and DHC-8-300/400 may actually be faster than comparable turbojets, such as the BAe-146.
- (b) Speed Control – While it may be true that speed control is more precise with a turboprop aircraft, it depends on the propeller rpm being used on final approach. Some airlines, as standard operating procedure, require 900 rpm on final, which decreases thrust response to throttle input. To mix well with large turbojet aircraft, additional speed carried on final, which may create 700-1000' of float.
- (c) Eye Height – The eye height of the CV580, HS 748, and DHC-7 are close to the eye height of some smaller jets, like the DC-9 and B-737. Also, some of the smaller jets, like the CRJ and EMB-145, have eye heights similar to the Saab 340 and other smaller turboprops.
- (d) Reverse Thrust – Some turboprops use “disking” in their landing distance calculations, so selection of prop settings different from this could increase the landing distance. Interlocks that prevent selection of below flight idle rpm have been installed as safety measure on some aircraft. And some turboprops have only a “ground fine” position, and no reverse.

**9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.** [Since industry practice may be different than what is required by the FAR (e.g., general industry practice may be more restrictive), explain how each element of the proposed change to the standards affects the level of safety relative to current industry practice. Explain whether current industry practice is in compliance with the proposed standard.]

Current industry practice is a mix of compliance with the existing standard and the proposed, more stringent standard. Thus, relative to industry practice, the level of safety

is increased. In addition, the level of safety is made the same for all turbine engine powered aircraft.

**10 - What other options have been considered and why were they not selected?**

[Explain what other options were considered, and why they were not selected (e.g., cost/benefit, unacceptable decrease in the level of safety, lack of consensus, etc.) Include the pros and cons associated with each alternative.]

The only other option considered was maintenance of the existing standard. This was not selected due to the discrimination, determined to be no longer valid, based on performance characteristics presumed because of differences between turbopropeller and turbojet powered aircraft.

**11 - Who would be affected by the proposed change?** [Identify the parties that would be materially affected by the rule change – airplane manufacturers, airplane operators, etc.]

Operators of turbopropeller aircraft currently complying with the existing standard but not the proposed, more stringent standard, would be affected. The greatest impact is anticipated for operations in areas where runways are frequently wet, where the distance between alternates (in compliance with the revised standard) is relatively long, or for which the aircraft are operated near the maximum weight for the runway used.

**12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble?** [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

N/A

**13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?** [Indicate whether the existing advisory material (if any) is adequate. If the current advisory material is not adequate, indicate whether the existing material should be revised, or new material provided. Also, either insert the text of the proposed advisory material here, or summarize the information it will contain, and indicate what form it will be in (e.g., Advisory Circular, policy, Order, etc.)]

Existing material is adequate.

**14 - How does the proposed standard compare to the current ICAO standard?**

[Indicate whether the proposed standard complies with or does not comply with the applicable ICAO standards (if any)]

ICAO Annex 6, chapter 5, attachment C, example 3, paragraph 5.1.1 requires only that the landing performance permit the aircraft to be brought to a stop within the effective runway length. Thus, the margins provided by the proposed standard are more conservative than the ICAO standard.

**15. – Does the proposed standard affect other HWG's?** [Indicate whether the proposed standard should be reviewed by other harmonization working groups and why.]

No.

**16 - What is the cost impact of complying with the proposed standard?** [Please provide information that will assist in estimating the change in cost (either positive or negative) of the proposed rule. For example, if new tests or designs are required, what is known with respect to the testing or engineering costs? If new equipment is required, what can be reported relative to purchase, installation, and maintenance costs? In contrast, if the proposed rule relieves industry of testing or other costs, please provide any known estimate of costs.]

The cost impact is most significant in areas where runways are frequently wet, where the distance between alternates (in compliance with the revised standard) is relatively long, or for which the aircraft are operated near the maximum weight for the runway used. In other areas, the cost is considered minimal.

**17. - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.**

N/A

**18. – Does the HWG wish to answer any supplementary questions specific to this project?** [If the HWG can think of customized questions or concerns relevant to this project, please present the questions and the HWG answers and comments here.]

No.

**19. – Does the HWG want to review the draft NPRM prior to publication in the Federal Register?**

Yes.